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Indian Standard

SPECIFICATION FOR STANDARD SIGNAL GENERATOR IN THE FREQUENCY RANGE 30 MHz to 500 MHz

PART I METHODS OF MEASUREMENTS

UDC 621·373:621·317·3

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3

November 1982

Indian Standard

SPECIFICATION FOR STANDARD SIGNAL GENERATOR IN THE FREQUENCY RANGE 30 MHz to 500 MHz

PART I METHODS OF MEASUREMENTS

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(*Continued on page* 2)

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Indian Standard
SPECIFICATION FOR STANDARD SIGNAL GENERATOR IN THE FREQUENCY RANGE 30 MHz to 500 MHz

PART I METHODS OF MEASUREMENTS

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 22 June 1982, after the draft finalized by the Electronic Measuring Equipment Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The signal generator is widely used as testing instrument in electronic engineering and allied fields. In view of the rapid expansion of electronic industry in the country, the demand for each instrument has been on the increase. The need, therefore, has been felt for laying down minimum requirements of such instruments which would serve as a guide to the manufacturers and users.

0.3 The object of this standard (Part I) is to lay down the conditions and methods of measurements to be used for the testing of standard signal generator in the frequency range of 30 MHz to 500 MHz, in order to facilitate the comparison of the results of measurements.

0.4 These methods of measurement are for the assessment of a complete standard signal generator and do not apply to the component parts.

0.5 Performance requirements of the standard signal generator in the frequency range 30 MHz to 500 MHz are covered by IS:10211 (Part II)-1982*.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS:2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Standard signal generator in the frequency range 30 MHz to 500 MHz: Part II Performance requirements.

†Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part I) prescribes the conditions and procedures for the measurement of performance characteristics of standard signal generator in the frequency range of 30 MHz to 500 MHz.

1.2 This standard (Part I) does not include the methods of measurements for safety requirements of the signal generator.

2. TERMINOLOGY

2.1 For the purpose of this standard, following definitions shall apply.

2.1.1 *Standard Signal Generator* — A shielded source voltage or power, whose output level, frequency and the modulation characteristics are calibrated and usually variable over a range.

2.1.2 *Spurious Output* — The signals in the output of the generator which are not harmonically related to the fundamental frequency output.

2.1.3 *Residual FM* — Short term frequency instability or jitters of the output signal of the generator in CW mode.

2.1.4 *Residual AM* — Short term amplitude instability of the output of the generotor in CW mode.

2.1.5 *Incidental FM* — It is the frequency deviation produced when the signal is amplitude modulated.

2.1.6 *Incidental AM* — It is the percentage amplitude modulation produced when the signal is subjected to frequency modulation.

3. GENERAL CONDITIONS FOR MEASUREMENTS

3.1 Normal Supply Voltage

3.1.1 Rated power supply shall be applied to the signal generator during measurements.

3.1.2 The voltage applied to the standard signal generator shall be held constant within 1 percent of the rated value during the measurement of the characteristics.

3.1.3 In the case of ac mains operation, the voltage shall be applied at the rated frequency. The harmonic contents of ac mains supply shall not exceed 5 percent.

3.1.4 In the case of battery operation, the batteries of the type, rated voltage and capacity, as specified by the manufacturer, shall be used.

3.2 Standard Atmospheric Conditions for Tests

3.2.1 Unless otherwise specified, all tests shall be carried out under the following atmospheric conditions:

Temperature	15 to 35°C
Relative humidity	45 to 75 percent
Atmospheric pressure	86 to 106 kPa

3.2.2 Where the conditions mentioned in **3.2.1** have a significant influence, they shall be kept substantially constant during the tests.

3.2.3 For specific tests which are considered dependent on the atmospheric conditions the tests shall be conducted, and in the case of doubt, shall be repeated at a temperature of 27 ± 1°C and relative humidity of 65 ± 2 percent [*see* IS:9000 (Part I)-1977*].

3.2.4 The standard signal generator shall be protected from the electromagnetic radiations during the measurements.

3.2.5 The test instruments and standards used to check the performance characteristics of the standard signal generator shall have accuracies, at least four times better than the specified requirements of the particular characteristics for the signal generator.

4. MEASUREMENTS

4.1 Frequency Characteristics

4.1.1 *Frequency Accuracy*

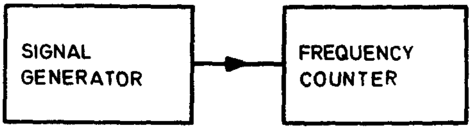


FIG. 1 MEASUREMENT OF FREQUENCY CHARACTERISTICS

4.1.1.1 Set up the equipment as shown in Fig. 1. Allow warm up time as specified by the manufacturer for stabilization. If not specified, allow the instrument to warm up for at least 2 hours.

4.1.1.2 Set up the signal generator in operation in CW mode and the output level to about 200 mV to get consistant frequency reading on the counter.

---

*Basic environmental testing procedures for electronic and electrical items: Part I General.

4.1.1.3 Check the frequency accuracy at 3 points in each range, that is lower, middle and higher end of the dial and record the readings.

4.1.2 *Frequency Stability*

4.1.2.1 Set up the instruments as shown in Fig. 1.

4.1.2.2 Set the frequency of the generator to any value at which stability has to be measured.

4.1.2.3 Allow for 2 hours of stabilization without disturbing any controls of the signal generator.

4.1.2.4 After the end of 2 hours, take measurements at 1 minute interval for 10 minutes and record the reading.

4.1.2.5 The variation in the 10 readings gives the frequency stability of the signal generator over short time.

4.2 Spectral Purity

4.2.1 *Harmonics*

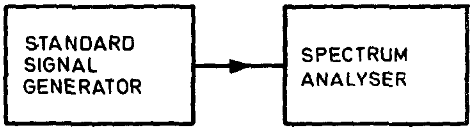


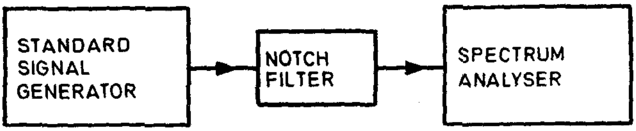
FIG. 2 MEASUREMENT OF HARMONICS

4.2.1.1 Set up the test equipment as shown in Fig. 2.

4.2.1.2 Set up the signal generator for any frequency in the CW mode. Set the output level at about −30 dBm or below, so that the input mixer of the spectrum analyzer is not over driven.

4.2.1.3 Measure and record the harmonic levels in dB below the carrier on the spectrum.

4.2.2 *Spurious*



NOTE — FM/AM Modulation meters with crystal controlled load oscillator facility may preferably be used to reduce the error due to IF drift.

FIG. 3 MEASUREMENT OF NON-HARMONIC SPURIOUS LEVELS

4.2.2.1 Set up the test equipment as shown in Fig. 3. Notch filter is used to cut off the carrier.

4.2.2.2 Tune the spectrum analyzer over the frequency range and note the non-harmonic spurious levels.

4.2.3 *Residual FM*

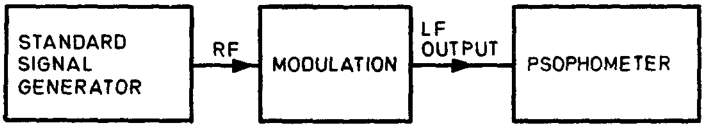


FIG. 4 MEASUREMENT OF RESIDUAL FM

4.2.3.1 Connect the test equipment as shown in Fig. 4.

4.2.3.2 Set the standard signal generator for a FM deviation of 5 KHz on the modulation meter.

4.2.3.3 Note the reading on the psophometer. This corresponds to the deviation of 5 KHz and thus the psophometer level corresponding to the FM deviation can be calculated.

4.2.3.4 Set the function switch of the standard signal generator to CW and note down the psophometer indicated level and calculate the residual FM.

4.2.4 *Residual AM*

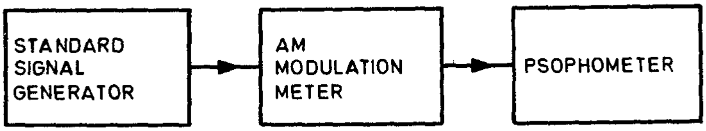


FIG. 5 MEASUREMENT OF RESIDUAL AM

4.2.4.1 Connect the test equipment as shown in Fig. 5.

4.2.4.2 Set the signal generator for 20 percent AM depth and record the psophometer level, and thus the psophometer level corresponding to the AM depth can be calculated.

4.2.4.3 Set the signal generator to CW, note the psophometer level and calculate the residual AM of the signal generator.

4.3 Output Characteristics

4.3.1 *Output Level Accuracy and Flatness Test*

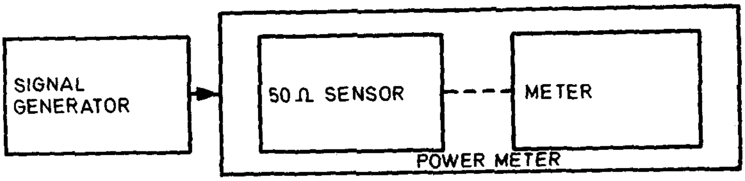


FIG. 6 MEASUREMENT OF OUTPUT LEVEL ACCURACY AND FLATNESS

4.3.1.1 Connect the test equipments as shown in Fig. 6.

4.3.1.2 Set the signal generator to the CW mode and set the output attenuator of the signal generator to −10 dBm position.

4.3.1.3 Record the indication of the power meter.

4.3.1.4 Repeat the measurement at three frequencies in each frequency band. This gives the accuracy and the output flatness of the level over the frequency range.

4.3.2 *Output Attenuator Accuracy*

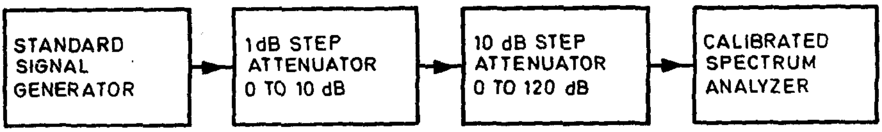

STANDARD SIGNAL GENERATOR
1dB STEP ATTENUATOR 0 TO 10 dB
10 dB STEP ATTENUATOR 0 TO 120 dB
CALIBRATED SPECTRUM ANALYZER

FIG. 7 MEASUREMENT OF OUTPUT ATTENUATOR ACCURACY

4.3.2.1 Connect the test equipment as shown in Fig. 7.

4.3.2.2 Set the signal generator to any frequency in CW mode and tune the spectrum analyzer to get the display.

4.3.2.3 Set the signal generator for the minimum attenuation position and the standard step attenuator for fully in position. Note reference display of the signal on the spectrum analyzer.

4.3.2.4 Check the output attenuator accuracy by substituting with the standard attenuator and recording the reference display of the signal on the spectrum analyzer.

4.3.2.5 Repeat the measurement in at least one frequency in all the frequency bands.

4.3.3 *Output Radiation Test*

4.3.3.1 The test shall be done in a suitable screened cage to cut off interference from external radiation and using an antenna.

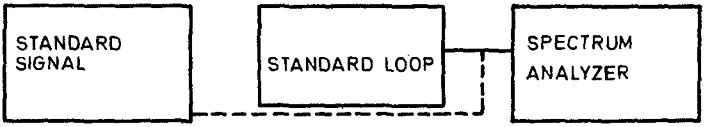


FIG. 8 MEASUREMENT OF OUTPUT RADIATION

4.3.3.2 Set up the test equipment as shown in Fig. 8.

4.3.3.3 The loop antenna used is of 2 turns of 2·54 cm diameter, of about 2·0 to 2·5 mm wire.

4.3.3.4 Set the signal generator in CW mode and introduce the full attenuator for the output and connect the spectrum analyzer. The signal generator should deliver rated power into the terminating load while checking measurements through the loop and spectrum analyzer radiation. Tune the spectrum analyzer for the display. Disconnect the spectrum analyzer and terminate the output of the signal generator with 50 ohms termination.

4.3.3.5 Connect the standard loop to the spectrum analyzer as above.

4.3.3.6 Hold the loop 2·54 cm away from all the surfaces of the generator, and note the spectrum analyzer displayed signal strength in μ volts.

4.3.3.7 The recorded level should be within the specification of 3 μ volts.

4.4 Modulation Characteristics

4.4.1 *AM Depth and Distortion*

4.4.1.1 Connect the output of the signal generator to AM modulation meter.

4.4.1.2 Check the modulation depth at intervals of 10 percent up to 90 percent and record the reading. The measurement is done with internal 1 KHz modulation.

4.4.1.3 With 30 percent modulation, connect the LF output of the modulation meter to a distortion analyzer and measure the envelope distortion.

4.4.1.4 Repeat the procedure at one frequency in each band.

4.4.2 *FM Deviation and Distortion*

4.4.2.1 Connect the standard signal generator to the FM modulation meter.

4.4.2.2 Check the frequency deviation in each range with the internal 1 KHz modulation and record.

4.4.2.3 Set the deviation to 100 KHz, connect the LF output of the modulation meter to a distortion analyzer and measure the FM distortion.

4.4.3 *Incidental AM*

4.4.3.1 Set the test equipment as shown in Fig. 5.

4.4.3.2 Perform the measurement as in **4.2.4.2.**

4.4.3.3 Set the generator for the FM and set the deviation for 100 KHz.

4.4.3.4 Record the reading in the psophometer and calculate the incidental AM of the generator.

4.4.4 *Incidental FM*

4.4.4.1 Set up the test equipment as shown in Fig. 4, and perform the measurements as in **4.2.3.2** and **4.2.3.3.**

4.4.4.2 Set the signal generator to AM. Note the reading on the psophometer and calculate the incidental FM of the signal generator.

INDIAN STANDARDS ON ELECTRONIC MEASURING EQUIPMENT

IS:	
1885 (Part XLVII)-1977	Electrotechnical vocabulary: Part XLVII Digital electronic equipment
2320-1963	Methods of measurements for amplitude modulated radio frequency signal generator (30 kc/s to 30 Mc/s)
2321-1963	Requirements for general purpose amplitude modulated radio frequency signal generators (30 kc/s to 30 Mc/s)
3437-1972	General requirements for direct reading pointer indicator type electronic voltmeter (*revised*)
3886-1966	Minimum requirements for general purpose audio frequency signal generator (30 c/s to 30 kc/s)
3915-1966	Methods of measurements on audio frequency signal generators (30 c/s to 30 kc/s)
4330-1967	Methods of measurements on cathode-ray oscilloscope (dc to 10 Mc/s)
6700-1972	Requirements for general purpose cathode-ray oscilloscope
6756-1972	Technical documentation to be supplied with electronic measuring equipment
6767	Direct reading point indicator type ac/dc electronic voltmeter:
(Part I)-1972	Methods of measurements
(Part II)-1972	Up to 30 MHz
(Part III)-1972	Up to 300 MHz
6769	Direct reading point indicator type ac electronic millivoltmeter:
(Part I)-1972	Methods of measurements
(Part II)-1972	With a frequency range of 2 Hz to 1 MHz
8290-1976	General purpose audio frequency output power meters
8573-1977	Digital electronic dc voltmeters and dc electronic analogue-to-digital converters
9176-1979	Method for specifying the functional performance of electronic measuring equipment
9177-1979	Method for specifying the functional performance of stabilized power supply apparatus
9281	Electronic weighing systems:
(Part I)-1979	Terms and definitions
(Part II)-1979	Methods of measurements
(Part III)-1981	Requirements
9285	Direct reading pointer indicator type ac electronic RF millivoltmeter:
(Part I)-1979	Methods of measurements
(Part II)-1979	Requirements
9298	Television pattern generators
(Part I)-1979	Requirements
(Part II)-1980	Methods of measurements
9711-1980	Synchronizing pulse generators
9741	Video test signal generators:
(Part I)-1981	Methods of measurements
(Part II)-1981	Requirements
9782-1981	Television sweep generators
9858-1981	Safety requirements for electronic measuring apparatus

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N=1kg. m/s^2
Energy	joule	J	1 J=1 N.m
Power	watt	W	1 W=1 J/s
Flux	weber	Wb	1 Wb=1 V.s
Flux density	tesla	T	1 T=1 Wb/m^2
Frequency	hertz	Hz	1 Hz=1 c/s (s^{-1})
Electric conductance	siemens	S	1 S=1 A/V
Electromotive force	volt	V	1 V=1 W/A
Pressure, stress	pascal	Pa	1 Pa=1 N/m^2